COAL MINE METHANE MARKET DEVELOPMENT IN CHINA

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1. INTRODUCTION

The total coal output in China in 1997 was 1.37 billion tons. It was estimated that the quantity of coal mine methane from Coal mining reached 9 billion m^3 per year in China. To improve the safety conditions, tests on gas drainage were successfully made in Longfeng mine, Fushun in the 1950s. After that, this technique was popularized at many highly gassy mines in this country. Up to 1998, 158 mines were equipped with underground methane drainage systems in China. The amount of methane drained reached 742 million m^3 per year. However, the quantity of coalbed methane utilized was less than 500 million m^3. There exits plenty of surplus coal mine methane that can be utilized by new projects. In recent years, the technique of developing the coal mine methane by surface well was introduced to some mines, which showed potentials of commercialization.

To promote coal mine methane drainage and utilization, China Coalbed Methane Clearinghouse and the US Environmental Protection Agency (USEPA) started a new cooperative project "Coal Mine Methane Market Development" in October 1999. The Clearinghouse will select nine coal mining areas which have economical potential of coal mine methane. The data packages will be made and distributed to the foreign investors. This paper concentrates on description of the favorable conditions for developing coal mine methane at coal mines and the plan for developing market.

2. PRESENT STATUS OF DEVELOPMENT AND UTILIZATION OF COAL MINE METHANE AT COAL MINES

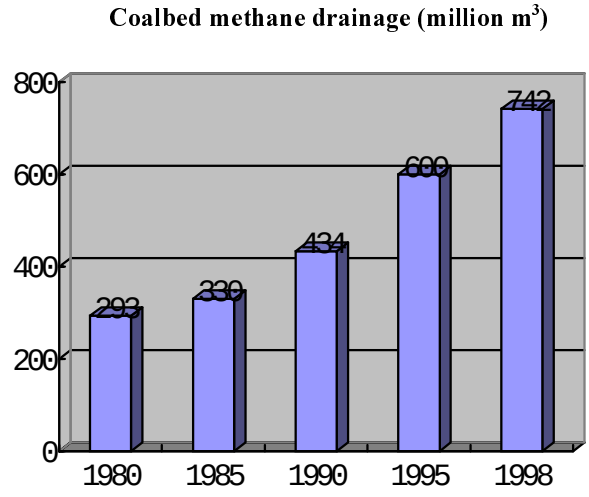

Fig.1 The amount of coal mine methane recovered from 1980 to 1998

2.1 Drainage of coal mine methane

The coal production from underground mines in China accounts for 96% of the total national coal output. The highly gassy coal mines and mines with proneness of gas outburst amount to 44% of the key State-owned mines in China. Gas explosion is a major cause of fatal accidents at coal mines. Practical experience has proved that underground gas drainage is a major technical measure for prevention of gas explosion. Up to 1998, underground gas drainage systems were established at 158 mines. The quantity of gas drained annually increased from 293 million m^3 in 1980 to 742 million m^3 in 1998 (see Fig.1). Since the beginning of the 1990s, surface well technique for developing coal mine methane has been introduced in China. The production tests of the surface well system made a breakthrough in Jincheng, Huaibei and Tiefa mining areas. The methane production from a single well reached 16,000 m^3 /d, which showed potentials of commercialization.

2.2 Utilization of coalbed methane

Since the 1980s, 50 projects have been set up for utilization of coal mine methane using funds for energy saving and for technical innovation provided by the government. Currently, about 500 million m^3 of methane is used mainly as town gas per year. There is big surplus of coal mine methane which can be utilized by new projects.

3. POTENTIALS FOR DEVELOPMENT OF COAL MINE METHANE MARKET IN MINING AREAS

Considering experience obtained in the US, virgin coalfields with abundant coal reserves and good reservoir conditions are suitable for setting up large scale commercial production base of coalbed methane, San Juan coalfield is just an example. Hedong coalfield in China also has a great potential for development. However, in the near future, we shall concentrate our efforts on developing coal mine methane in existing coal mining areas. Then, what are the favorable conditions for developing coal mine methane in coal mine areas in China?

3.1 Reliable coalbed methane resources

In accordance with the project “Development of Coalbed Methane Resources in China” aided by the UN and relevant reports by China Coalbed Methane Clearinghouse, we have selected 24 promising target areas in China. Except for Hedong coal field, the rest are all existing mine areas. The resources and reservoir conditions of coal mine methane are quite clear at active coal mines.

3.2 Perfect infrastructures

The major factor that restrains the large scale exploitation of coal mine methane is the trans-regional pipeline facilities for transportation of gas in China. There are good infrastructures in mining areas.

The gas transportation system for a multiple of drainage stations was built, including the gas holder and pump station.

3.3 Well established technique

The underground gas drainage system is well established in China. Tiefa mining area has introduced horizontal longhole drilling technique from the US in the implementation of an UN aided project. The drainage efficiency has reached 73.1%, much higher than the national average

efficiency of 21%. Tiefa and Huaibei mining areas have also successfully completed tests of gas drainage from gob areas from surface.

3.4 Bright prospects of market

(1) Town gas

The production of natural gas in China is only 22.3 billion m^3 in 1997, which is far from satisfying the need of the residents for combustion. The Chinese government intends to increase the percentage of urban residents who burn gas fuel. The government considers that it is an important measure to improve the quality of living and environment of the urban residents. Use of coal mine methane can be regarded as one of the best options to achieve above-mentioned goals. Many mining areas in China are cities themselves. There is a great potential market of burning gas by the residents. The residents in Kailuan, Yangquan and Hebi burn the coal mine methane drained from coal mines.

(2) Coal mine methane for power generation

When the mine is far from the city, and lacks pipeline transportation facilities, coal mine methane power generation is one of the optimal options. The use of coal mine methane for power generation is a successful experience both at home and abroad. The capacity of power plant that fires coal mine methane is 94 MW in Appine and Tower mines in Australia. Two small gas-fired power plants have been built in Jincheng mine area in China. The capacities of these two plants are 2×120kW and 4×400kW, respectively. Currently, a new plan of gas-fired power plants is being made. “Feasibility Study of Yangquan Coal Mine Methane Demonstration Project”, aided by the Asian Development Bank, is now underway. Power generation is regarded as a main option of coal mine methane utilization.

(3) Co-firing of coal mine methane and coal

Many coal mines in China have built power plants that burn coal refuse from the mines. When coal mine methane is supplied to power plant boilers to co-fire with coal refuse, the co-firing can not only improves the burning performance of coal refuse, but also saves coal.

(4) Fuel for vehicles

Coal mine methane can be used as a fuel for vehicles to replace gasoline. It is very popular in the Netherlands to use natural gas as a fuel for vehicles. The vehicles that burn natural gas have been put into use in Chongqing and Beijing in China. Jincheng Bureau is now contacting Xi'an Xiangyang Aviation Industry Inc. and Beijing Zhongyou Gas fueled Vehicles Development Company. It plans to retrofit the existing vehicles into dual-fuel vehicles, and to build a compressed station of coalbed methane and a gas supply station.

(5) Production of chemical products

Some of the coal mining area in China use coal mine methane for producing formaldehyde and carbon black, these are Huainan, Fushun, Zhongliangshan, Songzao and Tianfu mining area. Coal mine methane can also be used for production of synthetic ammonia.

3.5 Preferential policies

In order to encourage development and utilization of coal mine methane, the Chinese government has worked out preferential policies in the following:

- Development of coalbed methane using surface wells. All the foreign companies that

participate in development of coalbed methane can enjoy the same preferential policies for international cooperation in the field of oil and natural gas. The added value tax of coalbed methane projects is reduced to 5%;

- Utilization of coal mine methane. The projects of development and utilization of coal mine methane drained from underground coal mines are to be listed in the "List of Comprehensive Utilization of Resources" and enjoy relevant preferential policies in taxation. The enterprises are exempt from income tax and regulation tax for the first five years after operation.

4. PLAN FOR IMPLEMENTATION OF THE PROJECT "COAL MINE METHANE MARKET DEVELOPMENT"

Table 1

Evaluation of potentials for developing coal mine methane in target mining areas

	Yangquan	Jincheng	Panjiang-Liuzhi	Tiefa	Huaibei	Huannan	Pingding-shan	Hancheng
Area (km^2)	2070	342.52	21569	157	6190	2126	650	115.7
Thickness of coal seams (m)	2.25–37.02	3.75–16.90	20 – 40	5 – 88	0.10–76.52	4.87-80.8	5.94-35.33	38.6-85.8
Depth of coal seams (m)	150-730	116-670	150-1500	300-800	600-1000	500-1500	200-1000	300-1000
Coal rank	Anthra-cite	Anthra-cite	Coking, Lean, Meager	Semi-Anthra-cite, Gas	Gas, Fat, Coking	Gas	Fat, Coking, Lean	Lean, Meager, Anthra-cite
Reflectivity Ro, max (%)	2.26-2.59	3.71-4.25	0.8-2.5	0.58-0.71	0.7-1.0	0.8-1.48	0.85-1.64	1.66-2.01
Methane content (m^3/t)	2.8-24	4.32-32.74	10-20	5-7	2-25	2.05-15.88	5-11	6.23-16.12
Longmuir volume $V_L(m^3/t)$	24.81	37.57	N/A	13.93	13	18.08	15.45	21
Longmuir pressure P_L(Mpa)	1.93	2.36	N/A	4.91	3	3.81	2.05	1.65
CBM resources (10^8m^3)	8683.03	616.53	10385	87.77	3159.42	3497.73	652.27	1705
Density of CBM resources(10^8 m^3/km^2)	4.19	1.8	0.48	0.56	1.19	1.4	0.88	1.54
Permeability (md)	0.5-6.7	3.61	0.1-1.65	0.39	0.4-3.2	0.01-0.39	1.0	2.0-3.5

4.1 Outline of the project

In April 1999, Mr. Yang Han, Deputy Director of Planning Department of the State Administration of Coal Industry and Mr. Nitze, Assistant Administrator of USEPA, signed the Statement of Intent on a Coal Mine Methane Market Development Project at the Environment

and Development Forum. The Clearinghouse is engaged to undertake this project, which is to be for two years starting from October 1st, 1999. The main scope of work includes selection of potential coal mine methane projects and preparation of data packages which can be provided to potential investors.

4.2 Implementation of the project

On the basis of investigations, we have preliminarily chosen the coal mining area of Yangquan, Jincheng, Panjiang, Tiefa, Huaibei, Huainan, Pingdingshan and Hancheng as the target areas for methane market development. These areas are abundant in coal mine methane resources (see Table 1). They have been equipped with underground drainage systems (see Table 2), and (or) have set up pilot projects for methane development using surface well. They have good infrastructures, technical conditions and a great potential market for coalbed methane and have made plans for developing coal mine methane.

These nine mining areas possess systematic and reliable basic data which can be used for reference. We shall collect and study the data of these projects and make economic evaluations. We shall prepare data packages in a united pattern and distribute them directly to relevant international organizations and foreign companies. We also can disseminate the data package to investors through the China Coal Information Institute web site at www.coalinfo.ac.cn.

Table 2

Quantity of Coal Mine Methane Drained From Target Coal Mining Area

Coal mining area	Quantity of coal mine methane Drained (million m^3)						
Year	1985	1990	1993	1995	1996	1997	1998
Yangquan	89.52	76.91	90.53	92.68	100.95	115.23	115.15
Panjiang	0.01	5.64	15.00	20.58	18.29	28.69	36.35
Tiefa	1.80	10.17	16.26	22.11	23.52	33.13	36.00
Huaibei	4.25	3.16	4.66	4.53	5.04	7.02	7.90
Huainan	4.74	4.06	4.20	5.00	6.60	10.45	22.60
Pingdingshan	0	0	0.65	3.30	5.79	12.59	24.49
Hancheng	0	0	1.09	1.18	1.10	1.43	3.09

4.3 Pilot project data package

The data packages of the coal mine methane development market will be written in such a way with which the investors in the western world are familiar. The USEPA will provide necessary technical assistance. The Business Advisory Committee (BAC) will give guidance to the Clearinghouse for the work. Among the nine target areas, China Coalbed Methane Clearinghouse is working together with specialists from ICF company, US for a project aidedby the Asian Development Bank at Yangquan mining area. We will select the data packages for Jincheng as the first example for the projects of market development.

The main contents of the packages will include the followings:

(1) Background information regarding the coal mining area and the coal mining. It describes location of the mines, communication and transport conditions, the history of mining and annual coal production.

(2) Resources of coal mine methane and characteristics of the reservoir. It describes the block

area of coal mine methane, the amount of coal mine methane resources, gas content, permeability, reservoir pressure and other parameters.

(3) Present status of coal mine methane development. It describes the existing facilities and technologies for underground methane drainage and surface well drainage systems.

(4) Plans for coal mine methane market development. It describes the supply and demand of energy in the local market and analyses market potential for coal mine methane and suggests options for use of coal mine methane.

(5) Demand for techniques and investment, method of cooperation as well.

(6) Description of proposed projects including economic evaluation.